Coping with Huge Temporary Increase of Inflow to WWTP
Resulting from Trunk Sewer Rehabilitation

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1. Background
Tokyo’s sewerage has been constructed for the past 120 years, and the increase of aging and deteriorating of the facilities has now become serious problem. The Bureau of Sewerage has promoted projected rehabilitation. Recently, at the central area of Tokyo, in a main trunk sewer running under one of the heavy-trafficked trunk roads, a serious concrete deterioration was found caused by hydrogen sulfide generation. The deterioration level was so extended as possible to cause a serious road caving (Fig. 1) that the Bureau decided its urgent rehabilitation. As there was no relief sewer nearby, the upstream sewage flow had to be diverted to another drainage area - Shibaura drainage area, and to be treated at Shibaura WWTP.
This describes how to cope with the increase of influent.

2. Problem
Table 1 shows daily average sewage treatment volume and sludge generation volume in Shibaura WWTP, which employs conventional activated sludge process. Generated sludge is pumped to another WWTP. The increase of inflow would be up to 170,000 m³/d which was around 25% of daily average. Treatment of such large volume of sewage would bring two risks. One was that effluent quality could not meet the standards. The other was that it would generate sludge much over the existing sludge pipeline capacity.
As the rehabilitation work period, two months from November to December were chosen,
avoiding treatment efficiency decrease due to low water temperature and storm water inflow by rain.

3. Staffing
To keep the effluent in proper quality and to manage sludge increase, a task force composed of various specialists was organized in Shibaura WWTP. The objectives of the project were to make risk identification and assessment; to make up effective and practical countermeasures.

4. Risk identification and countermeasures
4.1 Sewage treatment
4.1.1 Hydraulic retention time (HRT)
HRT would be shortened from 8.6 to 6.7hrs during receiving sewage. To make full use of existing treatment facilities, the task force decided to stop all repair and improvement works of them. To secure suitable HRT at all 6 lines of reactors, the distribution of influent depending on each processing capacity was calculated.

4.1.2 Effluent quality
Results of the estimation with the previous effluent quality data showed that risks of not meeting the standards for BOD, COD and phosphorous should be low. However as for nitrogen, the risk of not meeting the standard was found high because SRT necessary for nitrification would not be obtained. So, facilitating nitrification became the major issue of the treatment during the period.
To facilitate nitrification, MLDO was required to be kept over 3.0 mg/L and MLSS was increased from 1,200 - 1,500 mg/L to 1,800mg/L. High nitrification rate was kept to prepare for the increase of inflow.

4.2 Sludge treatment
Results of the estimation with the previous data revealed daily sludge generation would increase as much as 34 DS-ton/day.
During the period, if total sludge was pumped, the sludge density would be over limit. So, to dewater part of generated sludge, centrifugal dewatering machines were temporarily set and dewatered cake was carried out by trucks.
As odor emits both from dewatering and carrying out processes, tents were put around dewatering machines (Fig.2). To minimize odor, chemicals such as poly-ferric-sulfate was injected in the sludge. Moreover, for the case of amount of the sludge generation exceeds over the estimation, a part of treatment facilities were ready for use as a sludge storage tank.

5. Results
5.1 Sewage treatment
Increase of inflow was 170,000 m$^3$/d as estimated. Throughout the whole period, the effluent quality satisfied the standards. But near the end of the period, as water temperature went down, nitrifying rate decreased and total nitrogen (TN) of the effluent increased just under the standard, 30mg/L (Fig.3).

5.2 Sludge treatment
The sludge generation volume was 32 DS-ton/day within the estimation. The injection of chemicals was effective and prevented odor complaints from residents living in the vicinity.

6. Conclusion
The success of this project was brought by risk identification, quantitative risk assessment, and preparation of countermeasures.
The experiences of this drainage basin change can be adopted as a useful alternative method in large scale sewer rehabilitation work.